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INTERMEDIATE-LEVEL MAINTENANCE FOR NAVY TACTICAL  
MISSILES CAN BE BETTER MANAGED(U) GENERAL ACCOUNTING  
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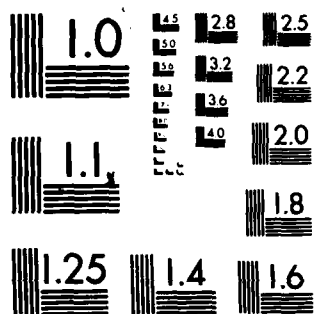
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UNITED STATES GENERAL ACCOUNTING OFFICE  
WASHINGTON, D.C. 20548

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NATIONAL SECURITY AND  
INTERNATIONAL AFFAIRS DIVISION

R-214349

MARCH 5, 1984

The Honorable John F. Lehman  
The Secretary of the Navy

Dear Mr. Secretary:

Subject: Intermediate-Level Maintenance for Navy Tactical  
Missiles Can Be Better Managed  
(GAO/NSIAD-84-64)

Our review of the Navy's management of intermediate-level maintenance for tactical missiles shows that, although the Navy has made some improvements since our 1980 report, the Navy needs to make further improvements if such maintenance is to be effectively managed. The cost of this maintenance was about \$23 million in fiscal year 1983.

Better techniques are needed to monitor and evaluate the performance of missile maintenance activities for air- and surface-launched missiles. Currently, maintenance program managers do not collect, analyze, or compare the actual labor-hour expenditures among the various maintenance activities. As a result, they do not have a basis for evaluating activity budgets, measuring productivity, and setting work goals. Consistent, thorough data-gathering and analysis of labor-hour expenditures as well as comparisons would provide these managers a data base for identifying cost-saving, productivity-enhancing measures.

Work measurement standards have fostered consistency in the labor-hour expenditures for air-launched missile maintenance and have greatly facilitated the budget preparation process. Such standards, however, have not been developed for the surface-launched missile program, whose maintenance activities are experiencing substantial fluctuations in their labor-hour budgets and expenditures. The use of work-measurement standards should bring the surface-launched missile maintenance program the same benefits they have already brought the air-launched missile maintenance program.

In view of these considerations, we recommend that you direct both air- and surface-launched missile maintenance managers to (1) collect actual labor-hour expenditure data from

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their activities, (2) analyze and compare this data, and (3) based on the data, set specific goals for improving maintenance productivity. We also recommend that you direct the surface-launched missile maintenance managers to develop work-measurement standards for the major intermediate-level maintenance jobs.

In providing official oral comments on a draft of this report, agency officials agreed with our recommendations. Our findings, recommendations, and agency comments are discussed in more detail in the enclosure.

As you know, 31 U.S.C. §720 requires the head of a federal agency to submit a written statement on actions taken on our recommendations to the Senate Committee on Governmental Affairs and the House Committee on Government Operations no later than 60 days after the date of the report and to the House and Senate Committees on Appropriations with the agency's first request for appropriations made more than 60 days after the date of the report.

We are sending copies of this report to the Chairmen of the above committees; the Chairmen, Senate and House Committees on Armed Services; the Secretary of Defense; and the Director, Office of Management and Budget.

Sincerely yours,

*Frank C. Conahan*  
Frank C. Conahan  
Director

Enclosure

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INTERMEDIATE-LEVEL MAINTENANCE FOR  
NAVY TACTICAL MISSILES CAN BE BETTER MANAGED

INTERMEDIATE MAINTENANCE RESPONSIBILITIES

Navy tactical missiles are divided into two categories for maintenance purposes--air-launched and surface-launched. Air-launched missiles (ALMs) are those usually fired from Navy aircraft and include the Sidewinder, Sparrow, Phoenix, Shrike, Walleye, Standard ARM, and Harpoon. Surface-launched missiles (SLMs) are usually fired from surface ships; they include the Terrier, Tartar, Standard SM-1 Medium Range, SM-1 Extended Range, and the new SM-2.

Much of the maintenance performed on these weapons occurs at the intermediate level and consists mainly of testing missiles and their components for serviceability and readiness. Actual repair at this level is generally limited to replacing non-serviceable components and performing exterior appearance work, such as painting surfaces or repairing nicked fins.

Intermediate-level maintenance (ILM) is performed by military and civilian personnel primarily at four naval weapons stations located at Concord and Seal Beach, California; Charleston, South Carolina; and Yorktown, Virginia. Intermediate maintenance costs for fiscal year 1983 were about \$14.5 million for the ALM program and \$8.4 million for the SLM program.

The Naval Air Systems Command (NAVAIR) is responsible for managing the ALM maintenance program. It is assisted by the Pacific Missile Test Center in Point Mugu, California. Their responsibilities include determining requirements, coordinating work loads, and preparing and executing financial budgets. The Naval Sea Systems Command (NAVSEA) is responsible for managing the SLM maintenance program. It is assisted by the Naval Ship Weapons Systems Engineering Station at Port Hueneme, California.

OBJECTIVE, SCOPE, AND METHODOLOGY

Our overall objective was to evaluate the Navy's management of intermediate-level maintenance for tactical missiles. More specifically, we evaluated (1) the use of work measurement systems for monitoring and controlling that maintenance and (2) the Navy's progress in implementing recommendations from our prior report--Navy Missile Maintenance Can Be Done Cheaper by Improving Productivity (LCD-80-43, April 9, 1980).

We performed this review from January through September 1983 at those Navy organizations that manage or perform intermediate-level maintenance on ALMs and SLMs. A complete list follows:

Headquarters commands

Naval Material Command, Washington, D.C.  
Naval Air Systems Command, Washington, D.C.  
Naval Sea Systems Command, Washington, D.C.

Engineering activities

Naval Ship Weapons Systems Engineering Station,  
Port Hueneme, California  
Pacific Missile Test Center, Point Mugu, California

Maintenance activities

Charleston Naval Weapons Station, Charleston, South  
Carolina  
Concord Naval Weapons Station, Concord, California  
Seal Beach Naval Weapons Station, Seal Beach,  
California, and the Fallbrook Annex, Fallbrook,  
California  
Yorktown Naval Weapons Station, Yorktown, Virginia

To meet our objective, we reviewed agency regulations, reports, studies, plans, and budgets and interviewed Navy officials about missile maintenance. At each maintenance activity visited, we (1) interviewed planners and managers concerning local policies and practices, (2) observed maintenance operations, and (3) collected and analyzed work load and productivity information for fiscal years 1981 and 1982, and the first half of fiscal year 1983 (through March).

To evaluate the use of labor standards, we selected and analyzed the labor hours expended on nine ALM and eight SLM maintenance jobs. The ALM maintenance jobs were performed by both Seal Beach and Yorktown Naval Weapons Stations and the SLM maintenance jobs were performed, for the most part, by all four weapons stations visited. We chose these jobs because they represented both a cross-section of complex and routine maintenance jobs performed on several different missile systems and a significant part of total intermediate maintenance budget costs. In addition, Navy officials assured us that the work content or scope for these jobs remained fairly constant over the analysis period.

Our review was made in accordance with generally accepted government audit standards.

PROGRESS HAS BEEN MADE  
SINCE OUR 1980 REPORT

In 1980 we reported that the Navy had not tailored its intermediate missile maintenance resources to effectively meet its needs. We also reported that the Navy did not have

an effective work measurement system for monitoring and controlling missile maintenance. The report contained several recommendations addressing these areas.

Since that report, the Navy has improved its management of intermediate-level missile maintenance. For example, the Navy has analyzed and quantified its maintenance requirements and capacity. As a result, the Navy has eliminated excess capacity at several locations. This was done by centralizing its west coast ALM work load, according to missile type, and by consolidating the Terrier/Tartar part of its SLM work load at one location on each coast.

Additional improvements have been made in the ALM maintenance program. Since the 1980 report, the ALM maintenance managers have implemented a system of engineered labor standards for most ALM maintenance jobs performed by the weapons stations. These standards are used to achieve consistency in weapon stations' work and as a tool to develop and evaluate maintenance budgets.

We believe these changes are commendable. However, as discussed below, we also believe the Navy needs to make additional improvements.

#### MAINTENANCE MANAGERS NEED TO IMPROVE PERFORMANCE EVALUATION

The managers of weapon maintenance programs should ensure not only that all required maintenance is performed but also that such maintenance is performed economically and efficiently. To do so, the managers need detailed work load and performance data to (1) minimize the resources needed to meet maintenance demands, (2) measure, evaluate, and compare the performance of maintenance activities, and (3) promote efficiency and productivity at every level.

Department of Defense and Navy instructions recognize that performance measurement and evaluation processes are essential to accurately monitor performance and to wisely allocate resources. Moreover, Navy policy requires managers at all levels to pursue performance improvement initiatives, including the use of labor standards in a work-measurement system and the establishment of productivity improvement goals. Also, our prior report recommended improvements in performance measurement and evaluation in the missile maintenance programs.

However, neither the ALM nor the SLM maintenance program managers are collecting, analyzing, and comparing actual performance data (labor-hours per unit of work) from their activities. Also, they have not established performance improvement goals. As a result, these maintenance managers are losing opportunities to improve efficiency and reduce costs.

NAVAIR's performance  
monitoring and evaluation

NAVAIR's performance monitoring and evaluation consist primarily of three parts: (1) reviewing missile readiness statistics, (2) comparing work scheduled and completed by each maintenance activity, and (3) comparing the labor-hours per maintenance job budgeted by each activity with the labor-hour standard devised by NAVAIR. These measures spotlight progress and problems and provide NAVAIR important information for evaluating maintenance activities' budget estimates. For example, by comparing labor-hour estimates to standards, NAVAIR ensures that the scope and cost of work among activities are reasonable and consistent. The table below shows the consistency in budgeted labor hours for selected jobs performed by Yorktown and Seal Beach Naval Weapons Stations.

Budgeted Hours Per Job  
Fiscal Year 1983

<u>Job</u>	<u>Hours budgeted</u>		<u>Variance from lower number</u>	
	<u>Yorktown</u>	<u>Seal Beach</u>	<u>Hours</u>	<u>Percent</u>
Phoenix ILM	19.85	20.95	1.10	5.5
Shrike ILM	14.93	12.86	2.07	16.1
Walleye I ILM	21.03	19.72	1.31	6.6
Walleye II ILM	22.87	21.80	1.07	4.9

Although its current performance monitoring and evaluation processes are having some positive effect in achieving budget consistency, NAVAIR still needs to collect, analyze, and compare actual labor-hours per unit from its maintenance activities. This information is needed (1) to assess the accuracy of labor standards used in negotiating and establishing annual budgets and (2) to establish baseline data for setting productivity goals and measuring progress toward them. Without the actual labor-hour information, NAVAIR could budget more labor hours for a job than experience has shown is necessary.

For example, for fiscal year 1983 Yorktown and NAVAIR agreed on a fixed price of \$568 per unit for intermediate-level maintenance of the Shrike AGM 45-6. This price was based on NAVAIR's standard of 14.93 labor-hours per unit and Yorktown's stabilized rate of \$38.04 per labor hour. However, our comparison of performance data from Yorktown showed that the actual labor-hours per unit was, on the average, only 13.52 and 13.86 hours in fiscal years 1981 and 1982, respectively--an average expenditure of 13.69 labor-hours per unit for the 873 units completed during those 2 years. If this average of the actual labor-hours per unit, rather than the NAVAIR standard, had been used to price this work, NAVAIR could have reduced fiscal year 1983 funding of



\$136,320 for this job by \$11,321 (based on the projected work load of 240 units). Current work at Yorktown confirms that reliance on the actual data would have been justified; in the first half of fiscal year 1983 Yorktown expended an average of only 12.51 labor-hours per unit, having performed the job on 120 units.

NAVAIR officials agree that collection, analysis, and comparison of actual labor-hour expenditure data is needed as part of their performance evaluation. Although NAVAIR has not requested such information in the past, it has recently asked each maintenance activity to submit actual labor-hour data for fiscal year 1983 and plans to request this information annually in the future. The NAVAIR program manager told us that, with this information, performance baseline data will be established to measure maintenance efficiency and productivity.

NAVSEA's performance monitoring and evaluation

In monitoring and evaluating SLM maintenance, NAVSEA primarily reviews missile readiness information and compares work scheduled and completed by each maintenance activity. Like NAVAIR, NAVSEA does not collect, analyze, or compare actual labor-hour data and has not established productivity improvement goals. Unlike NAVAIR, however, NAVSEA has not developed usable labor standards for SLM maintenance jobs.

With neither labor standards nor historical (actual) labor-hour data, NAVSEA cannot adequately evaluate the reasonableness of activity budget estimates nor can it identify and analyze significant performance variances among activities. Generally, NAVSEA accepts activity budget estimates even when they show significantly different labor-hour expenditures for the same maintenance work. As our analysis in the following table shows, the activities varied widely in labor hours budgeted for selected SLM jobs during fiscal year 1983. For some of these maintenance jobs, NAVSEA accepted budget estimates that were greater than the actual amount of labor hours expended on the jobs in the preceding year.

Selected SLM Labor-Hour Estimates and Expenditures

<u>Job</u>	<u>Maintenance activity</u>				<u>Variance:</u>	
	<u>Yorktown</u>	<u>Seal</u>	<u>Charleston</u>	<u>Concord</u>	<u>lowest to highest</u>	
		<u>Beach</u>			<u>Hours</u>	<u>Percent</u>
	(hours per unit)					
SM-1 MR ILM						
1983 budget	56.06	45.08	34.68	41.70	21.38	61.6
1982 actual	57.29	58.17	39.36	12.66	45.51	359.5
SM-1 ER ILM						
1983 budget	56.06	43.48	30.01	36.80	26.05	86.8
1982 actual	50.99	51.55	34.48	17.91	33.64	187.8

The wide variances shown above result in wide variances in NAVSEA's budgeted cost per unit for the same job performed at different locations. This is illustrated below for the SM-1 ER ILM job.

SM-1 ER ILM for Fiscal Year 1983

	<u>Budgeted hours per unit</u>		<u>Stabilized hourly rate</u>		<u>Fixed price per unit</u>
Yorktown	56.06	x	\$29.94	=	\$1,678
Seal Beach	43.48	x	33.21	=	1,444
Charleston	30.01	x	42.68	=	1,281
Concord	36.80	x	36.38	=	1,339

The significance of these differences in the fixed price per unit becomes clear when the annual workload is considered. For instance, when the \$397 per unit difference for the SM-1 ER ILM job at Yorktown (\$1,678) and Charleston (\$1,281) is multiplied by the 463 units projected for Yorktown in fiscal year 1983, the result is that this work cost NAVSEA about \$184,000 more at Yorktown than if the same work had been performed at Charleston. This difference would be even greater if not for Yorktown's lower stabilized hourly rate, which lessened the effect of the large labor hours per unit variance between the two activities.

With an effective work measurement system of labor standards--or at least with historical performance data--NAVSEA could improve its evaluation of activity budget estimates. This would help ensure that (1) maintenance budgets reflect the minimum resources needed to complete the work and (2) activities achieve a greater consistency in the resources needed to perform the same work.

The NAVSEA program manager agreed that analysis of actual labor-hour information should be a part of NAVSEA's performance evaluation process and that it should help in negotiating budgets with the maintenance activities. In the past, the NAVSEA program office has asked activity managers to submit actual labor-hour data, but some of them, not wishing the program office to become involved in the detailed management of their activities, were reluctant to comply. Managers at the four activities we visited said they would now submit such data if asked.

USE OF WORK MEASUREMENT STANDARDS  
IN MISSILE MAINTENANCE IS BENEFICIAL

Although Navy policy and instructions require that work measurement standards be used in all direct labor operations, developing and maintaining a credible work-measurement system based upon engineered labor standards is expensive. Consequently, such standards should be developed and applied only to those operations where the benefits would outweigh the costs. When

engineered standards are not cost-effective, managers should collect and use historical labor-hour data as a less expensive (though less reliable) method for measuring efficiency and evaluating budget estimates.

NAVAIR has established engineered labor standards for ALM maintenance. While the exact cost/benefit ratio for those standards is not known, discussions with Navy officials and our analysis of changes in labor hours for ALM and SLM jobs lead us to conclude that they are generating considerable benefits (see below). Therefore, we believe that NAVSEA should establish a similar program for its SLM maintenance.

Cost and benefits of NAVAIR's  
labor standards program

NAVAIR initially began developing labor standards for intermediate-level maintenance on ALMs in November 1975. By October 1980, it had established standards for the Sidewinder, Sparrow, Phoenix, Shrike, Harpoon, and Walleye missiles at a cost of \$681,000. Since that time NAVAIR has spent an additional \$306,000 to update these standards.

When it began using these standards in maintenance budget negotiations, NAVAIR viewed them more as a means to justify activity and program budgets than as a work-measurement tool and, therefore, did not collect detailed information on their effect. As a result, NAVAIR could not track changes in actual labor-hour expenditures per work unit, which meant that it could not measure the effect its standards were having on maintenance efficiency.

Although it has little quantifiable evidence, NAVAIR considers its standards to be cost-effective. NAVAIR believes that these standards have improved labor efficiency, reduced costs, and brought greater consistency to the maintenance activities. In addition, NAVAIR credits its standards program with bringing about several other benefits:

- Projecting and justifying maintenance program costs more precisely and reliably.
- Improving productivity as activities' performance has reached or come close to engineered labor-hour standards.
- Highlighting and resolving problems more quickly.
- Conducting budget negotiations with maintenance activities in a more businesslike manner.

Because NAVAIR has little quantifiable evidence of the effect of standards on maintenance efficiency, we performed a limited analysis. We wanted some indication of the effect standards have had on the ALM maintenance program to compare to the

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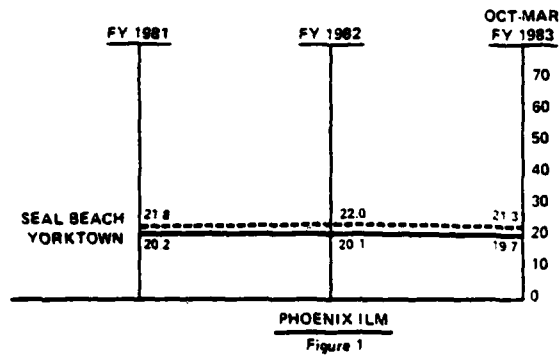
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SLM program, which has no labor standards. To do so, we chose several typical intermediate-level maintenance jobs from each program and analyzed any changes that occurred in each activity's labor-hour expenditures for those jobs during the period October 1980 through March 1983. According to both the ALM and SLM offices, the work content or scope of these jobs was fairly constant during that period.

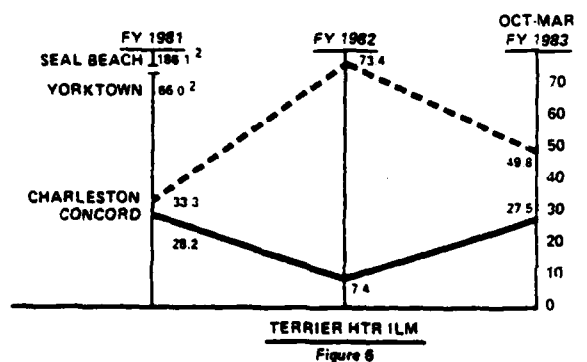
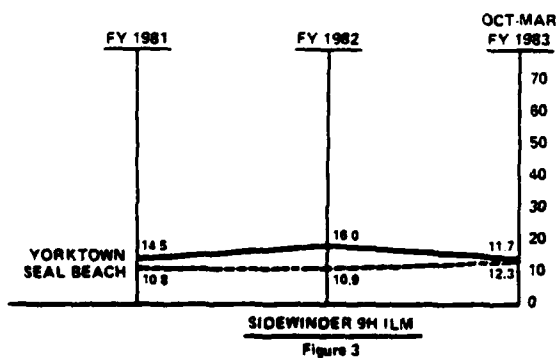
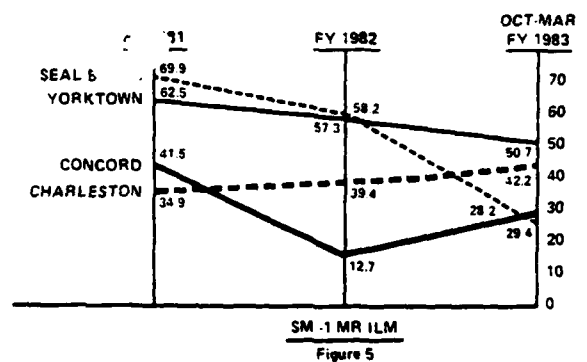
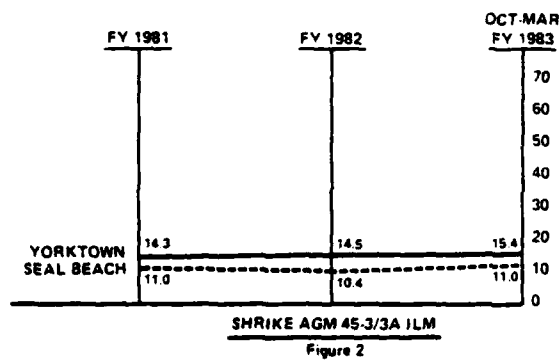
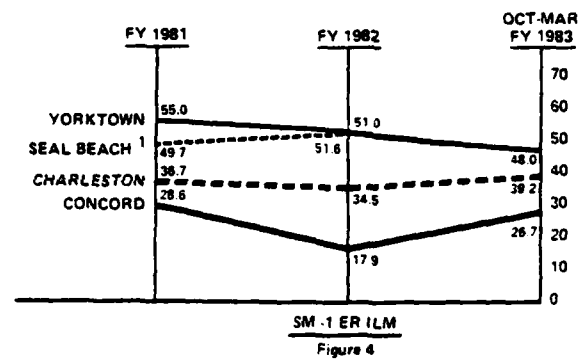
The following graphs illustrate some of the results of our analysis. Figures 1, 2, and 3 show the changes in average actual labor-hour expenditures per unit for three ALM maintenance jobs while figures 4, 5, and 6 show the changes for three SLM jobs. Although not shown on the graphs, the labor standards for the ALM jobs closely approximated the actual labor hours.

## AVERAGE ACTUAL LABOR HOURS PER UNIT FOR SELECTED MISSILE JOBS

## Air Launched Missiles



## Surface Launched Missiles



<sup>1</sup> SM-1 ER ILM was not performed at Seal Beach during the first half of FY 1983.

<sup>2</sup> Terrier HTR ILM was consolidated at one location on each coast in FY 1982.

The ALM graphs indicate that labor standards have helped stabilize unit labor-hour expenditures for the ALM program. Relatively little change occurred from year to year, and consistency was achieved between the two activities performing the same work. According to NAVAIR, in addition to consistency, the standards have facilitated the budget process, improved labor efficiency, and reduced costs.

The SLM graphs show a different story. SLM labor-hour expenditures per unit for each activity fluctuated considerably from year to year, and significant variances occurred among activities performing the same job. For some jobs, the variance in labor-hour expenditures among the maintenance activities greatly exceeded 100 percent. Moreover, as discussed previously, large labor-hour variances can result in large cost variances for the same work.

NAVSEA recognizes that significant variances exist in the labor hours used on SLM maintenance jobs, but without labor standards and actual labor-hour data it has not been able to identify and investigate the extent or causes of those variances. NAVSEA said that personnel shortages and higher priority work have prevented the Naval Ship Weapons Systems Engineering Station from developing SLM labor standards. NAVSEA agrees that labor standards would improve its maintenance program, and it plans to develop those standards. However, at the time of our visit in September 1983, standards development had not been initiated.

#### CONCLUSIONS AND RECOMMENDATIONS

The Navy has made some progress since our 1980 report, but we believe additional improvements are needed. Navy missile maintenance managers need to improve their monitoring and evaluation of maintenance activity performance to increase productivity and reduce costs. If they are to evaluate activity budget estimates and develop baseline data for productivity measurement and goals, maintenance managers must collect, analyze, and compare the actual labor-hour expenditures of the activities. SLM maintenance managers, moreover, should pursue the development and use of work measurement standards for their maintenance. In the absence of such standards the activities performing SLM maintenance have exhibited significant variances in their labor-hour budgets and expenditures for the same jobs, while the introduction of such standards in the ALM maintenance program has facilitated budget negotiations and achieved considerable consistency among activities in labor-hour expenditures for the same job.

Accordingly, we recommend that the Secretary of the Navy direct:

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- ALM and SLM maintenance managers to (1) collect actual labor-hour expenditure data from the maintenance activities, (2) analyze and compare this data, and (3) based on the data, set specific goals for improving maintenance productivity.
- SLM maintenance managers to develop work measurement standards for the major intermediate-level maintenance jobs.

AGENCY COMMENTS

On February 10, 1984, we met with Department of Defense and Navy officials to obtain their official oral comments on a draft of this report. They agreed with our recommendations and told us their plans for implementing them. The officials stated that, starting in March 1984, the weapons stations will forward actual labor-hour expenditure data to NAVAIR and NAVSFA each quarter. Maintenance managers will review and compare this data to budgeted estimates and, based on that review, will establish specific goals for improving productivity. The officials also stated that SLM maintenance managers have been directed to develop work measurement standards. A 3-year time phased program will start in 1984.

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